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THE DIGITAL CLINIC: CHANGING COMMAND AND CONTROL ORGANIZATION ARCHITECTURES FOR THE INFORMATION AGE (U)

by

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A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

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INTRODUCTION

Network-Centric Warfare (NCW) has been the burning topic of discussion in military circles since it first came to light as a concept after the 1997 QDR. It has been heralded by its supporters as a “revolution in military affairs” (RMA). However its critics, like Richard J. Harknett, describe it as a “...series of ad-hoc assumptions about perfect training, perfect coordination, and perfect innovation. Its advocates, furthermore, have yet to address the possibility of unanticipated side effects and new vulnerabilities.”¹ Others are not as committed to either side of the argument, and lie somewhere in the “middle ground.”² In its Capstone Concept for NCW, the U.S. Navy states: “The transition to Network Centric Operations will not change the validity of the enduring nature and the principles of warfare, but it will require the development of new doctrine, stronger educational under-pinnings that leverage information, knowledge, and advanced technologies in the conduct of decisive, effects-based operations.”³ Debate will continue between the advocates of NCW and its critics. This paper does not address those issues. Rather, it considers how future command organizations must adapt to the environmental uncertainty in which they operate and how network-centric operations can contribute to that organizations development: this applies to heterogeneous as well as homogeneous organization structures. I use CENTCOM as a case study for the heterogeneous organization and the operational function of fires for the homogeneous. Before proposing changes in the C2 organization I first provide a detailed description of CENTCOM’s current command and control organization. CENTCOM’s organizational structure has not undergone major revision since the Gulf War. What has changed in CENTCOM, however, is the ability to derive real time, shared awareness among its forces participating in operations in their area of responsibility via the common operational picture (COP).⁴ Also, CENTCOM’s AOR provides an excellent model for analysis of a very dynamic region with high environmental uncertainty. I also draw on lessons from the U.S. Navy’s Fleet Battle Experiment-India (FBE-I) conducted by Naval Warfare Development Command (NWDC) during summer 2001. Three changes to CENTCOM’s organization structure are offered. The approaches to change

are scaled through time so that doctrine, organization, and technology can be phased in a coevolutionary effort.

There are cases where introduction of new technology will spur a change in organization as did the introduction of radar to the Battle of Britain.⁵ As new network and information technologies improve the way we see our world, it is probable the organization and doctrine of our military forces must be changed as well.⁶ NCW is providing the technology, we now have to begin to tackle the questions of how to reconfigure our organizational structures to best exploit these new technologies.

WHERE ARE WE GOING AS A MILITARY?

Joint Vision 2010 (JV 2010) and the follow-on *Joint Vision 2020* (JV 2020) have laid the foundation for where the armed forces are heading in the future.⁷ The services are engaged in transformation to networked forces in one form or the other. The U.S. Army's "Force XXI" has adopted a network-centric approach to war fighting, utilizing smaller, lighter, more mobile forces to conduct "swarming" operations.⁸ The Navy is using its Fleet Battle Experiments to explore the conduct of operations in a networked environment. The Marines are adopting network centric practices as well and are conducting war games as proof of concept.⁹ The push in our land forces is from large, cold war type heavy units, to smaller, lighter more mobile ones. These scaled-down mobile land forces will increasingly rely on direct and indirect fires provided by land, sea, and air based assets. As advances in networking and shared information continue to be made, the line between tactical, operational and strategic fires will likely become blurred.¹⁰ An adaptive approach to their command will be required to provide the CINC with both sufficient centralized control, as in strategic, but permit sufficient self-synchronization down to the tactical level.¹¹

JV 2010 introduces the emerging concepts of Dominant Maneuver, Precision Engagement, Focused Logistics, and Full-Dimensional protection. These emerging operational concepts are enabled through information superiority.¹² The tenets of JV 2010 can be facilitated by operational architectures that closely integrate sensors, command and control, and shooters. The emerging operational architecture is a concept of a series of overlaying grids providing basis for a network, specifically three foundational grids overlaid on one another to provide a total picture of the battlespace. The three grids described are Information, Sensor, and Engagement. They will form what is normally referred to as "The Grid" or the "Global Information Grid (GIG)."¹³ (see Figure 1)

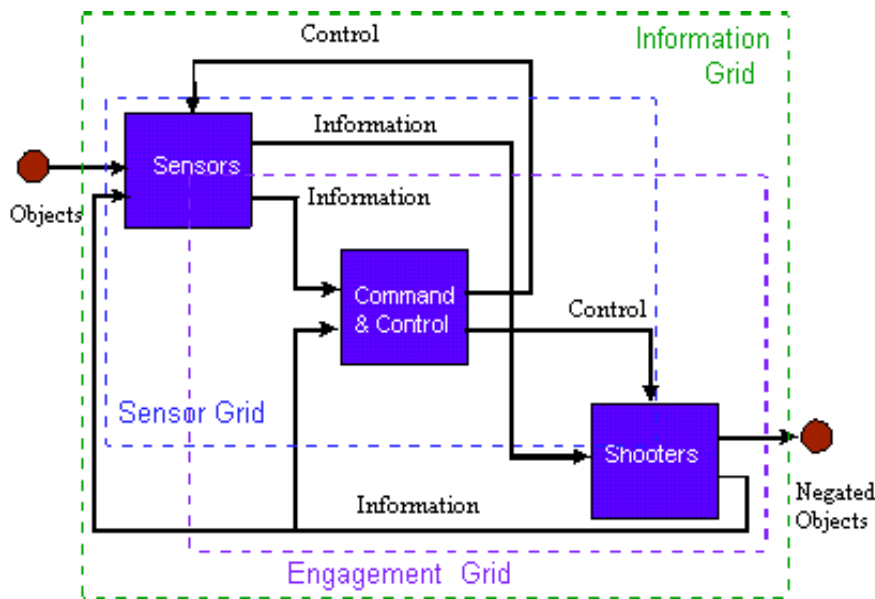


Figure 1. The Grid¹⁴

With this architecture, sensors, shooters, information, and command and control are no longer linear or hierarchical. Sensor information can pass directly to the shooter and vice versa. However, command and control has input to both sensor and shooter. The issue, as stated earlier, is how command and control organizations can be adapted to the network-centric approach to provide "topsighted" control, yet permit flexible, adaptable, self-synchronization.¹⁵

The future of where and how effective networked forces will be going has already been demonstrated in combat operations. In the air campaign against the Taliban and Al Qaeda in Afghanistan the U.S. Air Force and Navy have been applying the principles of NCW at the *tactical* level. Real time video is being fed from predator UAVs to the cockpit displays of USAF F-16's, AC-130 gun ships and USN F-18's. The pilots and crews of these aircraft are using this real time picture of the battlespace to engage enemy forces. According to John Steinbit, assistant SECDEF, "persistent ISR is letting us find a target in Afghanistan, combine it with a weapon, shoot a weapon and watch what happens...If we see that they try to escape in a truck, we can shoot that truck."¹⁶ What is occurring in Afghanistan right now is a near instantaneous ability to attack targets through tactical level self-synchronization. The facilitators of this real time targeting are a persistent ISR presence over

the battlefield provided by the Predator UAV and other technologies not previously available. What is not in place is a command and control structure to support the effort on a larger scale.

STRATEGIC, OPERATIONAL, AND TACTICAL FIRES: WHAT ARE THEY?

To understand the difference between the levels of war is to better understand the appropriate shape for any future command and control organization designed to govern each. Strategic fires are those fires designed to have a major effect on the course or outcome of a campaign or war. They are planned at the theatre-strategic level and usually take place outside of a major operation or campaigns boundaries.¹⁷ Dr. Milan Vego defines operational fires and states:

Operational fires are designed to achieve decisive impact on the outcome of a campaign or major operation. By definition they represent an inherently joint function. Operational fires are not to be confused with fire support, for they may not have direct impact on the success of operational maneuver. However they can affect it. Their realm lies in the operational and strategic depth of the enemy's defenses. At the same time operational fires should not be confused with strategic bombing aimed at destroying or weakening an enemy's warfighting capability. Operational fires are generally planned at the operational commander level. Like strategic fires, the planning and execution of operational fires takes a top-down approach.¹⁸

He further defines tactical fires and states:

Tactical fires support forces in direct contact with enemy forces by destroying or suppressing the enemy's direct and indirect fire support systems and air defenses. They are planned and executed by the tactical commander within a boundary or sector of an area of operations. In some cases there may be no clear distinctions between operational and tactical level fires. If one measure can be used as a discriminator it is

duration. Operational fires tend to last longer than tactical fires. Tactical fires can take a top-down or bottom-up approach to their planning.¹⁹

Although some may differ with his definitions, they are generally widely accepted and taught at the Naval War College.

A REGIONAL CINC'S COMMAND ORGANIZATION: CENTCOM's ORGANIZATIONAL STRUCTURE

The overarching premise for any CINC's staff is to achieve unity of effort through synchronization of forces in space and time. Currently in CENTCOM this is done through analog and procedural methods in line with current doctrinal procedures. CENTCOM's current organizational structure consists of functional elements (JFLCC, JFACC, and the JFMCC) as well as service elements (AFOR, LFOR, etc.). The functional elements integrate with conduits between them. One such conduit in CENTCOM is the battlefield coordination detachment (BCD), resident in the JFLCC, which acts as a information conduit between the JFLCC and the JFACC.²⁰ CENTCOM uses supported and supporting command relationships to segment its battlespace responsibilities among its functional commanders. The Deputy JFLCC (DJFLCC) is supported commander in land operations. The JFMCC is the supported commander in maritime and littoral operations. The JFACC is the supported commander outside of the DJFLCC area of operations (AO). The DJFLCC thus relies on the other functional commanders for support in executing his ground scheme of maneuver.²¹

USCENTCOM instruction R 525-1 vol. I and II describes how CENTCOM addresses the coordination and synchronization of fires.²² CENTCOM utilizes a joint targeting coordination board (JTCB), resident under the CINC, which is separate from the other functional commanders. The JTCB provides the CINC's guidance to the combat plans functions under the JFACC to be used for the creation of their fires plan executed via the Air Tasking Order (ATO).²³ This guidance, in turn, is passed to the mid range planning function conducted by the joint guidance, apportionment and targeting cell (JGATC). This cell prioritizes target nominations from each component commander based on the CINC's guidance. The JGATC then creates the joint target list (JTL) which is submitted to the JTCB for approval.²⁴

The JTL addresses targets to be serviced 72-hours in the future. Once "rubber stamped" by the JTCB, the JTL is given back to the JGATC for matching and apportionment of assets. The DJFLCC also has an input to the JTL process through their deep operations coordination cell (DOCC). Targets are nominated and passed down through two levels of strata from the DOCC to the Battlefield Coordination Element (BCE), then the BCD who in turn give the revised DJFLCC target nominations to the JGATC for integration into the 72-hour ATO cycle. The operational synchronization occurs at the JTCB where CINC guidance is turned into target priorities and operational sequencing occurs within the JGATC.²⁵

The CENTCOM process for planning and executing strategic, operational and tactical level fires involves many strata and hierarchical levels to develop a target list that can then be incorporated into the 72-hour ATO process. The process is further burdened by interservice rivalries and conflicts for apportionment of assets among the functional commanders. A organization that can mitigate these rivalries and decrease the turn around time of the ATO will begin to achieve the NCW objective. Technology and netted forces supported by a changed organizational structure are the solutions to such problems.

With the advent of the COP, increased use of distributed network forces, advances in precision and increased range of munitions, the old view of the segmented, linear battle space will likely undergo revision. Currently there is no joint doctrine pushing for a new lexicon that fits the enhancements on the conduct of operations in the future battlespace with networked forces. Joint Pub 3-09 still describes fire support coordination measures (FSCM) and C2 structures that were used over 30 years ago.²⁶ U.S. ARMY FM 3-0 published in June 2001 still refers to the FSCL as a FSCM. In the near-term, the familiarity of the FSCL to the forces will remain, but it must become more permissive than now.²⁷ For the future, this relic of a now outmoded AirLand Battle Doctrine must be removed as a *controlling* measure and a different approach offered. Attaining synchronization and unity of effort through mechanistic organizational structures and procedures will not suffice as advancements in technology offer more rapid and effective means to employ forces. This, in turn, will lead to

underutilization of new capabilities offered by network-centric warfare.

STATIC Environmental Changes DYNAMIC	I <u>Low Uncertainty</u> Mechanistic Few Departments	II <u>Low-Mod Uncertainty</u> Mechanistic Many Departments
	III <u>Hi-Moderate Uncertainty</u> Organic Structure (informal, decentralized) Few Departments, Boundary Spanning	IV <u>Hi Uncertainty</u> Organic Structure (informal, decentralized) Many Departments, differentiated, Boundary Spanning Many Integrating roles
Environmental Uncertainty		

REVISED C2 FOR THE NEAR TERM\

Figure 2: Duncan's Contingency Framework for Environmental Uncertainty and Organizational Response.²⁸

The four quadrants are defined by situational awareness (SA), or how much knowledge you have about the space, time, and force in which you are conducting operations. Within the quadrants are the required organizational characteristics--mechanistic or decentralized--for the given environmental condition. With high SA in quadrant I, centralized control with a supporting mechanistic structure suffices. As you move through quadrants II and III environmental uncertainty grows and environmental change becomes more dynamic. Eventually you reach quadrant IV, where uncertainty is high, change is dynamic, thus SA is decreased demanding a greater reliance on decentralization to combat these deficiencies in this environment. Duncan's typology will be used as the basis for the C2 changes I recommend for heterogeneous and homogeneous organization architectures for the near, mid and long term. This section addresses C2 changes for the near-term.

The approaches to change in the heterogeneous and homogeneous organization for the near-term will be modeled to CENTCOM's AOR as this region can be best described as residing squarely in quadrant IV.²⁹ In the region you have high environmental uncertainty that is very dynamic. Thus, the organizational structure best equipped to adapt itself in this region will need to be decentralized, organic, and flexible. If CENTCOM's AOR was characteristic of quadrant I, then a more centralized approach to the C2 organization could be adapted. Furthermore, you can break down the operational functions (homogeneous) as you have done with the overarching (heterogeneous) C2 organization. Simply stated, as you adapt the organization to its environment you can *adapt the units within the organization* using the same uncertainty principles. In this case I focus on operational fires within CENTCOM's AOR.

At the strategic level not much will have to change as the planning that has occurred is relevant to a stable environment with many known variables. The enemy will have a hard time moving his factories, dams, or other large fixed targets that the strategic level of fires typically addresses. These targets can be addressed in the ATO and served by a variety of munitions depending on the desired effect. Often these strategic-level targets are already resident in the JTL for a given OPLAN. The principle of mass and unity of effort are handled by JTCB through the ATO and quality control process inherent in its production. Targets can be revisited if required based on BDA compiled through ISR assets.

This ties in with Figure Two that matches the relative level of control to SA. In this case, with strategic level targets or effects, the SA is relatively high, therefore a centralized command approach is best suited for conduct of operations at this level. Tactical level fires represent a movement on the SA scale toward quadrant IV of Figure Two. This quadrant represents more uncertainty and thus C2 of tactical fires should rely more on an organic, decentralized, approach for control. As such, calls for fire (CFF) and requests for close air support (CAS) can be best facilitated by an apportionment decision made either prior to the day's events, or on the fly utilizing the COP.³⁰ A more decentralized approach can be developed that fosters self-synchronization at lower levels of command in order to achieve local objectives and effects.

CENTCOM presently accomplishes this by the use of kill boxes. Kill boxes allow air assets to be pushed to various geographically sectioned areas to be handled by Forward Air Controllers (FACs) for the servicing of targets in that FAC's resident kill box. If no targets are available, the fighters can be sent to backup targets, or pushed to another kill box. This system permits self-synchronization at the tactical level.³¹

Currently all kill box activity occurs beyond the FSCL. A more permissive FSCM can be developed to facilitate the control of fires by removal of the FSCL as a control measure and permit an expansion of the "kill

box mentality". Currently the DJFLCC in CENTCOM owns all the battlespace up to the FSCL and out to the edge of his area of operations (AO). To achieve a more adaptive fires

execution the relationship between the DJFLCC and his supporting functional commanders must be addressed.

The hybrid control of joint fires used in FBE-I may be one way to improve this relationship.³² Another approach would be to use the enhanced SA provided by the COP. This approach would migrate an overlay of ground forces into the picture. No Fire Zones (NFZ) and Restricted Operating Zones (ROZ) could be established around friendly forces. When migrated to the COP, the networked force would have SA on those areas where they would not be allowed to engage targets unless permission was granted from the DJFLCC. In effect you have created one giant kill box over the entire operational area. As targets are identified real time in the battlespace and migrated to the COP, shooters can nominate themselves to engage. "Topsight" control will be provided through the JGATC to resolve apportionment or weapon-to- target pairing issues if they arise. The JGATC should allow self-synchronization to the maximum extent at the tactical level.

Operational fires present a different situation. On one hand you would like for these fires to be serviced like those at the tactical level through self-synchronization. However, operational fires are more analogous to strategic fires in their planning and execution. By definition operational fires are designed to shape the battlefield and inherently require more centralized command than those at the tactical level. Operational fires would tend to fall in quadrant II (see Figure Two), as their environment contains low to moderate uncertainty, thus a centralized, mechanistic-type control would suffice. For the near-term solution, operational fires would be handled like strategic fires and serviced through the ATO process. To support the increased tempo offered by networked forces, targets for operational fires could be offered to shooters via the network utilizing chat.³³ The JGATC provides "topsight" control, but only for cases where weapons-to-target pairing will not achieve the desired effect, or to break ties between competing platforms. Further, the JGATC ensures that commander's intent is

being followed by the supporting participants whether they are air, land, or sea based. The change for the near-term does not alter CENTCOM's existing command and control organizational structure on paper, just how it functions.

C2 CHANGES FOR THE MID TERM (10-12 years out)

Obviously changes to current organizational structures cannot be made overnight. Rather a sequenced approach to change must begin. Taking the C2 organization developed for the near-term, the mid-term approach begins to flatten the organizational structure by removal of layers of strata in the structure. The COP offers the ability, in the mid-term, to make small but effective changes in current regional CINC's organizational structure. Once such change would be the removal of the "rubber stamp"³⁴ echelons resident in current organizational structures. For example in CENTCOM the JTCB, JGATC, and various other "rubber stamp" levels in the command hierarchy could be removed and replaced with one *joint fusion cell*.

This cell would provide essentially the same services as the other elements with faster turn around time.³⁵ The joint fusion cell would possess the authority for apportionment and allocation of assets to serve targets based on weapons availability and matching weapon to target for the highest probability of kill. Joint teams would be set up within the cell to conduct the various levels of planning and execution required for the spectrum of fires.³⁶ Smart agents could be introduced to handle the information overload potential and further permit the cell to concentrate on current, near, mid, and long term planning and execution. As the focus of the operation changed, the various teams would have different priority on what they would be able to gain, asset wise, for the desired effect.

For example, prior to operations on the ground, the emphasis would be on strategic and operational fires. Once land forces were engaged in direct combat an effort parallel to strategic and operational fires would be supporting ground troops with tactical fires from various shooters, some organic, some not. Command of strategic and operational fires would remain centralized and be handled through an ATO process, but one more highly automated than in the past. The goal would be rapid turn-around time for targets contained on the JTL

and attacking new ones as they are detected in the battlespace via self-synchronization at the tactical level. The joint fusion cell would oversee the shooter-to-target pairings at all levels of war as well as ensure commander's intent is being adhered to by all players. Not achievable you say? FBE-I demonstrated this can be done, though not without problems, most of which were related to training, lack of familiarity with equipment and concepts, and lack of a C2 organization sufficient to support the operation. This, however, is to be expected in an experiment where new processes and technologies are being exercised for the first time. These problems can be rectified through further experimentation, practical application in real world environments, and development of supporting Tactics Techniques and Procedures (TTPs) and doctrine.

Underlying the three proposals is the impetus to develop a C2 organizational structure that takes full advantage of network-centric principles as they apply to the spectrum of fires. Again, using CENTCOM's organization as the case, the push is to create a heterogeneous organization that can function effectively in quadrant IV (see Figure Two): one that is organic, decentralized, flexible, and adaptable.

COMMAND ORGANIZATIONS WILL BECOME MORE HORIZONTAL: A PROPOSAL FOR THE C2 ORGANIZATION OF THE FUTURE

C2 systems must become more horizontal if we are to realize the benefits provided by networking and information systems.³⁷ Taking what was built, or torn down, from the mid-term approach, changes for the long-term further flatten the organization structure. With shared information the mid-level management functions of the JTCCB, JGATC, DOCC, BCE, etc. will be removed. In fact, the traditional functional commands will have to be removed as well.³⁸ This may seem a radical approach to the problem. However, future conflicts will demand we fight as a JTF. Inter-service rivalries have no place on this battlefield of the future. The existence of functional commanders tied to a particular service, and their service parochialisms, merely perpetuate such rivalries. In the future the services will still be responsible for training and supplying the CINC's with combat capability. However, the requirement for functional commands aligned along services is no longer useful. In their place we should organize along mission or, more preferably, task. The organizational structure of a professional football team provides a useful analogy.³⁹ You have a head coach, an offensive coordinator, a defensive coordinator, a special teams coach, and various supporting elements not tied directly to the conduct of the game. The CINC's staff of the future could be shaped in similar fashion.

The purpose of the offensive coordinator and his resident *offensive cell* would be to conduct offensive operations in support of the CINC's clearly stated operational objectives through commander's intent.⁴⁰ The offensive cell would consist of a ground forces specialist, an air forces specialist, a maritime specialist, coalition representatives and supporting personnel attached to each specialist's staff. Their common goal would be to conduct offensive operations in enemy territory without the kinds of bounds placed on current operations such as by a FSCL or other procedural method.⁴¹ They would use information dominance to rapidly find, fix, and

simultaneously attack time critical and pre-planned targets based on commander's intent, scheme of maneuver, or realities encountered in the battlespace.

This maneuver will be far different than what we know today. Force XXI is calling for a lighter, more mobile land force exploiting information and networked soldiers to achieve rapid and decisive operations against any foe.⁴² Swarming will be the re-visited combat tactic for the future.⁴³ If this lighter, more mobile force is confronted with a large armored force; air, land, and sea based fires can be massed to halt the advance. The swarm could then close in for the kill. These operations will require horizontal command and control structures to facilitate the rapidly exploding fierceness of such a battlespace and its associated flow of information. Stovepipe, mechanistic, organization structures that take 72-hours to produce an ATO do not suit this type of warfare.

The ATO as we know it may very well have disappeared by this time. However, the JTL may still exist in some fashion. The targets contained in the JTL will be serviced as strategic fires have been in the past, whether from B-2's launched from CONUS, or Tomahawk Land Attack Missiles (TLAMs) launched from submarines. In either case, reach-back capability--provided by NCW--will be available to the CINC for command of these assets. Operational fires will be conducted in a similar fashion, with the benefit of having more resources available given the advances in increased range of current and future weapons systems. Execution of tactical fires will blend more with operational fires as the COP provides the real-time picture of all players in the battlespace. Keeping the fires at the tactical level from exploding into a melee will be the responsibility of the operations execution cell.

The defensive coordinator and his corresponding *defensive cell* would be responsible for Theatre Ballistic Missile Defense (TBMD), Air Defense (AD), and various other force protection issues.⁴⁴ His sphere of control would predominantly be in and around friendly occupied territory and include ground, air, space, and

sea.⁴⁵ There may be a conflict over resource allocation and apportionment between the offensive and defensive coordinators, but with the total SA on ones enemy, the swing from offensive to defensive, or vice-versa, will be transparent.⁴⁶ Other defensive activities may be wholly unrelated to the offensive coordinator and require assets that are not needed by the offensive team (e.g. Patriot missile batteries).

Fusion and "topsighted" control of the offensive and defensive cells occurs in the *operations execution cell*.⁴⁷ If questions arise over apportionment or allocation of assets, the execution cell will be the adjudicating authority. The operations execution cell will continually interface with the CINC for updates to his intent, or changes to his objectives, based on realities confronted in the battlespace. With shared awareness the offensive and defensive coordinators can modify their game plans to achieve the CINC's revised objectives and continue to press the attack on the enemy. Using the task oriented cell approach is but one way to achieve the heterogeneous and homogeneous organization structure required to operate in quadrant IV (see Figure Two).

PITFALLS

The danger of blurring the levels of war as a result of actions, or perceptions, commanders may gain based on information provided via the COP is an issue. In the near-term this is a valid concern. However, this is generally applied broadly by critics as they look at current hierarchical command structures. Creating more organic, task oriented "cells", as suggested in this paper and by other authors, is one way of mitigating the problem. Further experimentation is required utilizing such C2 structures. Some conclusions on the adequacy, or inadequacy, of these organizational architectures can be found in industry and examples of these have been provided in this paper.

Dr. Barnett provides another slant on the issue. His concern is that the COP will not reflect the "real" world.⁴⁸ This is a false claim. The COP in use in CENTCOM is a *real time* display that is not distilled down. CINCENT and his staff have full access to all information, or they can pick-and-choose information displays as they desire. Unfortunately Dr. Barnett did not have the opportunity to see a COP being utilized in actual combat operations when he made this statement. Perhaps he should visit CENTCOM forward in Saudi Arabia for a first hand look.

CONCLUSION

The reality of our day is that networked warfare is upon us. Regional CINCs need to adapt their staffs to the technological evolutions ongoing in the information field. There exists an approach that can ease our forces into the new C2 structures that will foster enhanced operations in a networked environment. Experiments have shown these challenges are not insurmountable. Changes should occur commensurate with improvements in networking and information systems in a coevolutionary effort.⁴⁹ Some would say that in the pursuit of NCW

operational art as we know it will become outmoded. I do not agree. The operational commander must remain as an integral level of command and control from the national level down to the tactical level. As Dr. Milan Vego states:

Proponents of information warfare apparently ignore the fact that the commander's responsibilities are much broader--especially at the operational and strategic levels--than making decisions in combat or combat itself. An intermediate command echelon between tactical commanders and national or alliance/coalition and military strategic leadership is absolutely necessary to ensure uninterrupted planning in peacetime, crisis, and war. This level of command also establishes and maintains other operational functions specifically, intelligence, command and control warfare (C2W), operational fires, logistics, and protection. Synchronization of these functions must be planned and executed by the operational command echelon.⁵⁰ Information and networked forces will change the operational factors of space, force, and more importantly, time. It is debatable whether NCW can ever mitigate the fog and friction of war. What netted forces can provide is a faster, more efficient method of combat if sufficient measures are taken to construct the proper C2 organization architecture.

This paper has provided some solutions to the many C2 challenges networked forces present us. Many possibilities exist, and through continued experimentation and practical experience, the armed forces of the future will converge on the requisite doctrine, training, and TTPs that will support our networked war fighters into the future.

Notes

¹ Richard J. Harknett, "The Risks of a Networked Military," Orbis, (Winter 2000): 128.

² Erik J. Dahl, "Network Centric Warfare and the Death of Operational Art," (Unpublished Research Paper, U.S. Naval War College, Newport, RI: n.d.), 2.

³ Ibid.

⁴ CENTOM CONOPS for Common Operational Picture, draft, 1 Feb 2001.

⁵ David S. Alberts, John J. Garstka, and Frederick P. Stein, Network Centric Warfare: Developing and Leveraging Information Superiority, (Washington, DC: CCRP, 1999), 3.

⁶ David C. Gombert and Irving Lachow, Transforming U.S. Forces: Lessons from the Wider Revolution, 2000, <<http://www.rand.org/publications/IP/IP193/>>, [29 November 2001]. In their article Gompert and Lachow provide several examples of how leading corporations have evolved beyond their previous mechanistic organization structures into highly task oriented horizontal architectures that make best use of the information technological revolution. The results are seen in their profits. One can look at General Electric for example. They are also cautious to point out that the military is not like a business. The stakes are a bit higher. However, if the majority of our large corporations have made the shift from mechanistic to horizontal and organic organization structures then this type of re-organization should be relevant to the military establishment and its highly mechanistic organizational structures.

⁷ See JV 2010 and JV 2020 for further amplification.

⁸ Jackson L. Flake, "Force XXI and Beyond: Bridging the Power Gap with Fires," (Unpublished Research Paper, U.S. Army War College, Carlisle Barracks, PA: 1999), 4.

⁹ John Arquilla and David Ronfeldt, Swarming and the Future of Armed Conflict, (Santa Monica, CA: Rand, 1999), 81.

¹⁰ Milan Vego, Operational Warfare, (Newport, RI: U.S. Naval War College, 2000), 644.

¹¹ Carl Builder, Steven Bankes and Ricahrd Nordin, Command Concepts: A theory Derived From the Practice for Command and Control, (Santa Monica, Rand: 1999), 1-23.

¹² Joint Chiefs of Staff, Observations on the Emergence of Network-Centric Warfare, 1997, <<http://www.dtic.mil/jcs/j6/education/warfare.html>>, [15 December 20001]. The information grid is the fundamental building block for information superiority. Sensor grids provide the Joint Force Commander (JFC) with the operational capabilities necessary for achieving awareness across the Joint battlespace. The engagement grid provides the JFC with three new operational capabilities: predictive planning, integrated force management, and the ability to execute time-critical missions. In the construct of "The Grid" the three foundation grids are linked directly and indirectly to one another.

¹³ Joint Chiefs of Staff, Doctrine for Command, Control, Communication, and Computer (C4) Systems Support to Joint Operations, Joint Pub 6-0, (Washington, DC: 30 may 1995), II-12.

¹⁴ Ibid., 3.

¹⁵ The idea is not to limit the flow of information by having vertical mechanistic organizational structures. The organic approach to organizational structures appears to be one of the better ways of solving this problem. Top sight control provides structure so self-synchronization does not get out of control. The environment that the organization must operate in is yet another consideration when determining which organizational structures will best support networked forces. The term "topsighted" was originally termed by Arquilla and Ronfeldt and can be found in their text Swarming and the future of Armed Conflict, p.6.

¹⁶ Frank Tiboni, "Instantaneous Attack Capability Near For U.S.," Defense News, January 7-13 2001, <<http://www.ebird.dtic.mil/Jan2002/e200020107inst.htm>>, [7 January 2001].

¹⁷ Vego, 239.

¹⁸ Ibid., 242. They generally come in two flavors: Lethal and Non-lethal. Lethal operational fires are designed to delay, disrupt, destroy, or degrade enemy operational forces. An example of a lethal fire would be the bombing of an enemy airfield. Non-lethal fires are those fires designed to disrupt, impair, or delay the performance of enemy operational forces. An example of a non-lethal fire would be those aspects of Electronic Warfare not specifically to designed to destroy enemy SAM or IADs components, for instance jamming. The operational commander and his staff plan the fires to support the campaign or major operation.

¹⁹ Ibid., 239-242. Examples of tactical fires are naval surface fire support (NSFS) and Close Air Support (CAS).

²⁰ Robert J. D'Amico, William p. Orton, and Kevin M. Woods, "Deep Battlespace Synchronization: Achieving Unity of Effort," (Unpublished Research Paper, U.S. Naval War College, Newport, RI, 1997), 104.

²¹ Ibid., 105. In CENTCOM, the DJFLCC is the supported commander beyond the fire support coordination line (FSCL) out to the edge of his Area of Operations (AO). This becomes problematic for deconfliction purposes as a large volume of air traffic

occurs within this region of the battle space. Couple this with the Army's ability to strike with ATACM's, the Navy's ability to strike with TLAMs, and the problem of fratricide becomes an issue. The axiom "big sky little bullet" will not function as a responsible deconfliction apparatus. The problems of sequencing and synchronization, become ever more paramount as advances in range of future weapons systems allow lower echelon players entry into the deep battlespace operational fires game.

²² U.S. Central Command (CENTCOM), CINCs Warfighting Instructions. Operations Standing Operating Procedures, USCENTCOM REG 525-1, volumes 1 and 2, (MacDill AFB, FL, Headquarters U.S. Central Command, 1997), III-1 - III-2.

²³ Some prefer Integrated Tasking Order (ITO) as this has more of a joint flavor and is less parochial.

²⁴ Deconfliction of fires is accomplished through airspace control measures resident in the special instructions section of the ATO/ITO. These measures are usually agreed upon and coordinated through the JFACC, DJFLCC and sometimes the JMACC.

²⁵ D'Amico, Orton, and Woods, 108.

²⁶ See Joint Pub 3-09 Chapter 2 for further amplification and discussion on these measures and their organizational structures.

²⁷ U.S. Central Command (CENTCOM), CINCs Warfighting Instructions. Operations Standing Operating Procedures, USCENTCOM REG 525-1, volumes 1 and 2, (MacDill AFB, FL, Headquarters U.S. Central Command, 1997), III-1 - III-2. The guidance therein is conflicting. In one point the direction is to permit the FSCL to be permissive, at another the direction is to be more restrictive under the auspices of pretection of friendly forces. To what end, then, do the JFACC and the DJFLCC view the FSCL as permissive?

²⁸ Robert B. Duncan, "Characteristics of Organizational Environments and Perceived Environmental Uncertainty," Administrative Science Quarterly, (September 1972): 320; quoted in D'Amico, Orton, and Woods, 45.

²⁹ D'Amico, Orton, and Woods, 113.

³⁰ TACS/AAGS should be mentioned as this highly mechanistic structure will still be in use for the near term. More information can be found on the TACS/AAGS , requests for CAS, and how these are processed in Joint Pub 3-09. Removal of this sub-hierarchy to the organizational structure can be facilitated once the COP is fully on-line. The removal of this highly analog and procedural method for processing CAS and fires requests will greatly enhance the transition of the C2 organization to a more horizontal architecture and decrease the time required to serve shooter to target pairings.

³¹ The author has extensive personal experience in dealing with kill box procedures from DESERT STORM.

³² In FBE-I control of tactical fires was relegated to the responsible component commander based on need. For instance prior to the Marine forces STOM, the preponderance of fires assets were at the JFACC's disposal. As the Marines began their STOM the preponderance of assets were shifted to the JFMCC or the MARFOR depending on the situation. See Module 1, Key Observations Summary for FBE-I, p. 4.

³³ A similar methodology was tested with some success in FBE-I.

³⁴ D'Amico, Orton, and Woods, 167.

³⁵ Turn around times for time critical targets were often more than one hour. However, these results were assessed as resulting from hardware problems and difficulties in mensuration of target coordinates based on quality of sensor imagery. The marines reported that they could put rounds on target almost immediately. See FBE-I Module 2-Joint Fire Support of Maneuver, FBE-I final report, 15 Oct 2001.

³⁶ By "spectrum of fires" I imply inclusive fires from strategic to tactical.

³⁷ David C. Gombert and Irving Lachow, Transforming U.S. Forces: Lessons from the Wider Revolution, 2000, <<http://www.rand.org/publications/IP/IP193/>>, [29 November 2001]. Once again we can gain insight to the benefits provided from exploiting information technology by looking towards industry. Information technology offered such organizations as General Electric, 3M, and Texas Instruments the opportunity to become more productive, more intelligent, and more adaptable. See pp. 6-10 for further explanation.

³⁸ D'Amico, Orton, Woods, 183-190. Introduce the "Organic JTF" where the organization is adapting to the environment by forming many self-organizing teams within the functional cells of "offensive", "protection" and "execution". They focus on the planning cycle time and reducing this via the "Organic JTF." Compare this to General Elcetrics approach of a highly decentralized organization and I derive the solution lies in the middle. Part of that solution is removing the functional commanders, not so much the person, but the role.

³⁹ D'Amico, Orton, Woods introduced this corollary in their paper Deep Battlespace Synchronization: Achieving Unity of Effort. They also introduced the concept of the "Organic JTF": organized cells based on tasks. The JTF commander would still be the overall director of the execution of the operation. After all, it is his intent that is to be carried out by the various cells. Some cells can be added or dropped based on the mission or objective for the JTF. You wouldn't want to have a offensive cell when you are providing disaster relief for instance.

⁴⁰ D'Amico, Orton, and Woods, 187.

⁴¹ D'Amico, Orton, and Woods, 187.

⁴² Arquilla, 82.

⁴³ Arquilla, 18. Mongols did this in the 12th and 13th century.

⁴⁴ D'Amico, Orton, and Woods, 187.

⁴⁵ D'Amico, Orton, and Woods, 188-189. They introduce the concept of "offensive" and "protection" cells as part of their concept of the Organic JTF.

⁴⁶ Gained from author's personal experience in air combat operations utilizing fighter Data Link.

⁴⁷ D'Amico, Orton, Woods, 188.

⁴⁸ Thomas P. Barnett, "The Seven Deadly Sins of Network-Centric Warfare", U.S. Naval Institute Proceedings, (January 1999), vp.

⁴⁹ Garstka, Alberts, Stein 3.

⁵⁰ Vego, 625.

Abstract of

THE DIGITAL CINC: CHANGING COMMAND AND CONTROL ORGANIZATION

ARCHITECTURES FOR THE INFORMATION AGE

Joint Vision 2010, Joint Vision 2020, coupled with the tenets of Network-Centric Warfare and the impetus of our leadership to transform the military, have mandated our military forces proceed towards information based warfare. The warfighter in the U.S. military establishment, the regional commander-in-chief (CINC), is left to determine how best to organize his command and control structure to gain the benefits provided from emerging information technologies. He must decide whether his future organization architecture will remain hierarchical and mechanistic, or become an adaptable, highly flexible, decentralized organic architectures.

This paper's approach is a push towards the organic, decentralized, and flexible command and control (C2) organization that is adapted to its environment. CENTCOM is used as the case study for heterogeneous organizations and the operational function of fires is used for the homogeneous organization. Doctrine, Tactics, Techniques, and Procedures (TTPs) will need to be developed to aid and support the CINC in his endeavor. Current doctrine is permeated with organization structures that are over 30 years old. Our leadership has given us the vision, we must now begin to fulfill it. To do this requires changes to how the CINC of the future organizes his functional staff to prosecute his mission. This paper offers three proposals to change the current structures based on near, mid and long term factors.

BIBLIOGRAPHY

BOOKS

Alberts David S., John J. Garstka, and Frederick P. Stein. Network Centric Warfare: Developing and Leveraging Information Superiority. Washington DC: C4ISR Cooperative Research Program, 1999.

Arquilla, John and David Ronfeldt. Swarming and the Future of Conflict. Santa Monica, CA: Rand, 2000.

Builder, Carl, Steven Bakes, and Richard Nordin. Command Concepts: A Theory Derived From the Practice of Command and Control. Santa Monica, CA: Rand, 1999.

Libicki, Martin. Who Runs What on the Global Information Grid: Ways to Share Local and Global Responsibility. Santa Monica, CA: Rand, 2000.

Van Crevald, Martin L. Command in War. Cambridge, MA: Harvard University Press, 1985.

Vego, Milan N. Operational Warfare. Newport, RI: U.S. Naval War College, Department of Joint Military Operations, 2000.

UNPUBLISHED PAPERS

Bunker, Robert J. "Information Operations and the Conduct of Land Warfare." Unpublished Research Paper, U.S. Army Institute of Land Warfare, Arlington, VA: 1998.

D'Amico, Robert J., William P. Orton, and Kevin M. Woods. "Deep Battlespace Synchronization: Achieving Unity of Effort." Unpublished Research Paper, U.S. Naval War College, Newport, RI: 1997.

Flake, Jackson L. "Force XXI and Beyond: Bridging the Power Gap with Fires." Unpublished Research Paper, U.S. Army War College, Carlisle Barracks, PA: 1998.

French, Mark. "Digital C3 Systems on the Modern Battlefield: Tactical Systems with Strategic Implications for Combined Operations." Unpublished Research Paper, U.S. Army War College, Carlisle Barracks, PA: 1999.

Hall, Wayne M. "The Janus Paradox: The Army's Preparation for Conflicts of the 21st Century." Unpublished Research Paper, Institute of Land Warfare, Arlington, VA: 2000.

Keeley, Thomas F. "Network Centric Warfare--Wiring Joint Forces for battle: Are Operational Leaders Really Plugged In?" Unpublished Research Paper, U.S. Naval War College, Newport, RI: 2000.

Kilroy, Patrick J. "C4I Joint Interoperability: Can we achieve the JV 2010 Vision." Unpublished Research Paper, U.S. Naval War College, Newport, RI: 2000.

Mahon, Francis G. "Army After Next, Airland Battle 2000: Futuristic Concepts or Jules Vern?" Unpublished Research Paper, U.S. Army War College, Carlisle Barracks, PA: 1998.

Newman, Herb W. "Digital Data Warfare Tools: Should CINCs Have Control." Unpublished Research Paper, U.S. Army War College, Carlisle Barracks, PA: 1999.

PUBLISHED REPORTS

McClure, William B. *Technology and Command Implications for Military Operations in the 21st Century*. Maxwell AFB, AL: Air University, 2000.

Roman, Gregory A. *The Command and Control Dilemma: When Technology and Organizational Orientation Collide*. Maxwell AFB, AL: Air University, 1997.

U.S. Navy Warfare Development Command. *Fleet Battle Experiment India Final Report*. Institute for Joint Warfare Analysis, Naval Postgraduate School, Monterey, CA: 2001.

PERIODICALS

Barnett, Thomas, P.M. "The Seven Deadly Sins of Network-Centric Warfare." U.S. Naval Institute Proceedings (January 1999): v.p.

Bingham, Price T. "Transforming Warfare with Effects-Based Operations." Aerospace Power Journal (Spring 2001): 58-66.

Camden. "Swarming Attacks Challenge Western Ways of War." Signal (April 2001): v.p.

Cebrowski, Arthur and John Gartska. "Network-Centric Warfare." Proceedings - United States Naval Institute (January 1998): 28-35.

Cole, Ray. "Networking Battlespace: DoD Technology Demonstration Extends C3I Connectivity Down to the Squad Level." Armed Forces Journal International (July 2001): 36-39.

Dimaggio, Kathy, Capt USN and others. "Presence with Attitude." Proceedings - U.S. Naval Institute (October 2000): 76-80.

Duncan, Robert B. "Characteristics of Organizational Environments and Perceived Environmental Uncertainty." Administrative Science Quarterly (September 1972): 313-326.

Harknett, Richard J. "The Risks of a Networked Military." Orbis (Winter 2000): 127-143.

Hoffman, F.G., LtCol USMCR. "An Alternative to the 'System of Systems'." Marine Corps Gazette (October 2000): 18-21.

Krulak, Charles C. "Operational Maneuver From the Sea." National Security Studies Quarterly (Autumn 1996): 17-29.

Mayo, Dick, RADM, USN.. "From the Sea...to Cyberspace." Proceedings-U.S. Naval Institute (October 2000): 44-48.

New, Terry L. "Where to Draw the Line Between Air and Land Battle." Airpower Journal (Fall 1996): 35-49.

INTERNET SOURCES

Bucchi, Toney, VADM USN. "USS CORONADO Strikes Gold at Sea." Washington Times, June 2001.
<<http://www.dia.smil.mil/admin/EARLYBIRD/010612/e20010612coronado.htm>>
[7 December 2001].

Duffy, Daintry. "Information is a Weapon. What Will Happen When Every Soldier is Armed with it?" Darwin Magazine, Nov 2001.
<<http://www.dia.smil.mil/admin/EARLYBIRD/011107/s20011107info.htm>> [7 December 2001].

Gombert, David C. and Irving Lachow. "Transforming U.S. Forces: Lessons from the Wider Revolution." Rand, 2000. <<http://www.rand.org/publications/IP/IP193/>> [29 November 2001].

Roos, John G. "CONOPS 2020: Air Force Lays Out Broad Concept For Future Aerospace Operations." Armed Forces Journal International, June 2001.
<<http://www.dia.smil.mil/admin/EARLYBIRD/010607/s20010607conops.htm>>
[7 December 2001].

Smith, Edward, Jr. "Network Centric Warfare: What's the Point?" NWC Review, Winter 2001.
<http://www-info.cdf.navy.smil.mil/n83/QDR/webpages%202000/areas/qdr_articles> [7 December 2001].

Skibitski, P.J. "Navy, Air Force Join Hands to Improve Ability to Hit Fleeting Targets." Inside the Pentagon, June 22, 2000. <<http://in.acc.af.smil.mil/accis/INT/newsletters/june%2000/navy%20Air%20Force>>
[7 December 2001].

Tiboni, Frank. "Instantaneous Attack Capability Near For U.S." Defense News, January 7-13, 2001.
<<http://www.ebird.dtic.mil/Jan2002/e200020107inst.htm>> [7 January 2001].

U.S. Joint Chiefs of Staff. "Observations on the Emergence of Network Centric Warfare." 1997.
<<http://www.dtic.mil/jcs/j6/education/warfare.html>> [15 Dec 2001].

Weinberger, Sharon. "C3I Chief Says Military Must Adopt Network-Centric Warfare Concepts." Aerospace Daily, Aug 27, 2000. <<http://www.dia.smil.mil/admin/EARLYBIRD/010827/s2001082c3i.htm>> [7 December 2001].

INSTRUCTIONS, CONOPS, AND SERVICE MANUALS

U.S. Central Command. *CINCs Warfighting Instructions. Operations Standing Operating Procedures*, Volumes 1 and 2, USCENTCOM REG 525-1, MacDill AFB, FL: Headquarters, U.S. Central Command, 1997.

_____. *Concept of Operations for USCENTCOM Global Command and Control System Common Operational Picture(draft)*. MacDill AFB, FL: Headquarters, U.S. Central Command, 2001.

U.S. Department of the Army. *U.S. Army Field Manual 3-0: Operations*. Washington, DC: Headquarters Department of the Army, 2001.

JOINT PUBLICATIONS

U.S. Joint Chiefs of Staff. Department of Defense Dictionary of Military and Associated Terms. Joint Pub 1-02. Washington, DC: 12 April 2001.

_____. Doctrine for Joint Operations. Joint Pub 3-0. Washington, DC: 1 February 1995.

_____. Doctrine for Joint Fire Support. Joint Pub 3-09. Washington, DC: 12 May 1998.

_____. Doctrine for Command, Control, Communications, and Computer (C4) Systems Support to Joint Operations. Joint Pub 6-0. Washington, DC: 30 May 1995.